TAMPER EVIDENT CLOSURES FOR CONTAINERS

FIELD OF THE INVENTION

THIS INVENTION relates to tamper evident closures for containers such as bottles.

BACKGROUND TO THE INVENTION

The most commonly used type of tamper evident threaded closure has a series of protrusions which project inwardly from a skirt and interlock with a bead of the container. The protrusions are on a band which forms part of the skirt and which is joined along a line of weakening to the remainder of the skirt. The band itself has a transverse line of weakening extending across it. It is intended that any attempt to remove the cap causes the band to break along its transverse line of weakening. However, it is possible with care to remove such a closure without damaging it, and then screw it back onto the bottle again without damaging it. It consequently does not reveal tampering.

The present invention provides an improved tamper evident closure.

BRIEF DESCRIPTION OF THE INVENTION

According to a first aspect of the present invention there is provided a method of manufacturing a cap for closing a container, the method comprising moulding the cap with a skirt which is subdivided by a circumferentially extending

line of weakening into a main part and a band, at least the band being of heat shrinkable material.

The method of manufacturing can comprise moulding the cap and subsequently expanding the moulded band thereby to increase its diameter.

The band can be expanded mechanically by means of movable components of the mould, or can be subjected to air pressure which expands the band.

According to a second aspect of the present invention there is provided a cap which comprises a transverse end wall and a cylindrical skirt, an end portion of the skirt being in the form of a band which is connected to the skirt along a line of weakening, the band being of heat shrinkable material.

According to a third aspect of the present invention there is provided a method of closing a container which comprises fitting a cap as defined above onto the container, and subjecting the band to heating to shrink it onto the container.

According to a fourth aspect of the present invention there is provided a tamper evident cap which comprises a transverse end wall and a cylindrical skirt, the end portion of the skirt being in the form of a band joined to the remainder of the skirt by a series of bridges, the band having been stretched during manufacture and being of a material which shrinks when it is heated.

According to a fifth aspect of the present invention there is provided a tool for use in the manufacture of a tamper evident cap, the tool comprising a female mould and a mandrel which together define a mould cavity having the shape of the cap to be moulded, the mould cavity having a first part in which the greater part of the length of the skirt of the cap and a transverse end wall of the cap are moulded, a second part in which a band forming the end part of the skirt of the cap is moulded, and notches arranged in a circle, the notches joining the cavity parts and a series of bridges between the band and the remainder of the skirt being moulded in these notches, the inner diameter of at least a portion of the subsidiary cavity part being less than the inner diameter of at least a portion of the main cavity part.

According to a sixth aspect of the present invention there is provided a method of moulding a cap which comprises feeding synthetic plastics material to a mould cavity defined between surfaces of a mandrel and surfaces of a female mould, the mould cavity having the shape of the cap to be moulded, the mould cavity having a first part in which the greater part of the length of a skirt of the cap and a transverse end wall of the cap are moulded, a second part in which a band forming the end part of the skirt is moulded, and notches arranged in a circle and which join the cavity parts, the inner diameter of at least a portion of the subsidiary cavity part being less than the inner diameter of at least a portion of the main cavity part, and removing the moulded cap from the mandrel in such manner that the band is stretched as it passes over the part of the mandrel which defines the first part of the mould cavity.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the present invention, and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawings in which:-

Figure 1 is a section through a cap at an intermediate state in the moulding procedure;

Figure 2 is a similar section showing the cap at a later stage in the moulding procedure;

Figure 3 is a pictorial view showing the cap being presented to a bottle for fitting;

Figure 4 is a pictorial view showing the cap on the bottle;

Figure 5 is a diagrammatic section, to a larger scale, showing the cap and bottle of Figure 4;

Figure 6 is a view similar to that of Figure 4 and showing the cap after heat treatment;

Figure 7 is a diagrammatic section similar to that of Figure 5 and showing the cap after heat treatment;

Figure 8 is a section through a further cap;

Figure 9 is an axial section through a closed tool for use in manufacturing the cap of Figure 8;

Figure 10 shows the tool immediately after it has been opened; and

Figures 11a, 11b and 11c are sequence drawings showing a cap being rotated off a mandrel forming part of the tool of Figures 9 and 10.

DETAILED DESCRIPTION OF THE DRAWINGS

The cap 10 shown in Figures 1 to 7 comprises a transverse end wall 12 and a skirt 14. The skirt has internal threading at 16 which matches external threading of the neck (see Figures 5 and 7) of a container 18 which, in the illustrated embodiment, is in the form of a bottle.

The free end portion of the skirt 14 is in the form of a band 20. The band is joined to the main part 22 of the skirt 14 by a series of circumferentially spaced bridges 24. The effect of this is to provide a circumferentially extending line of perforations 26 which alternate with the bridges 24. The line of perforations 26 is interrupted by a non-perforated zone 28 (Figures 2 and 3) at which the band 20 is joined to the main part 22 of the skirt 14. The non-perforated zone 28 constitutes a bridge which is wider than the bridges 24.

The band 20 has a line of weakening 30 which extends from the free edge thereof to the line of perforations 26. The line of weakening 30 can comprise a series of perforations or a line where the band 20 is of reduced thickness.

As will clearly be seen from Figures 5 and 7, the band 20 is thinner than the main part 22 of the skirt 14, and there is an internal step at 32 where the change in thickness occurs.

The cap is moulded with its band 20 tapering inwardly as shown in Figure 1. Before the cap is removed from the mould the band 20 is stretched so that

it takes on the cylindrical configuration shown in Figure 2. This can be achieved either mechanically by means of parts of the mould which expand forcing the still soft band 20 outwardly or by applying air pressure. This latter method is a technique known as stretch blow moulding.

PET is the preferred material for the cap but any other heat shrinkable plastics material can be used.

If reference is now made to Figures 4 and 5, it will be seen that the cap 10 has been screwed onto the container 18 until the free edge of the band 20 is close to the flange 34 of the container. Movement of the cap 10 is limited by engagement between the bead 36 of the container and the step 32 where the main part 22 of the skirt 14 of the cap 10 merges with the band 20. Once the cap has been screwed onto the container as shown in Figures 4 and 5, the capped bottle moves into a heat shrink tunnel. The main purpose of heating the bottle is to shrink the bottler's conventional synthetic plastics material sleeve shaped label around the body of the bottle. The effect of the heat on the thin band 20 is to cause it to shrink back to the condition in which it was moulded (see Figure 1) which results in it tightly gripping the container between the bead 36 and the flange 34 (Figures 6 and 7).

Experimental work has shown that the band 20, once it has shrunk onto the container 18, is brittle. Any attempt to prise the band 20 off the container causes it to fail along the weakened line 30 which extends across it.

The cap 10 is removed from the container 18 by twisting it. The band 20, because it is a tight fit around the neck of the container, resists turning and the result is that the cap breaks along the line of weakening 30. The cap 10 also breaks along the line of perforations 24 and either separates from the remainder of the cap entirely or remains attached to it by way of the zone 28 across which the line of perforations 24 does not extend. The fact that the cap 10 has previously been removed from the container is evident because the band 20 is either missing completely or is only attached to the remainder of the cap at the zone 28 but broken along its axially extending line of weakening.

The cap 38 shown in Figure 8 has a transverse end wall 40 and a cylindrical skirt designated 42. The skirt comprises a main part 44 and a subsidiary part in the form of a band 46. The band 46 is joined to the skirt part 44 by way of a series of bridges 48. There are openings 50 between adjacent bridges. The configuration of the cap 38 will be described in more detail hereinafter. On the inside of the skirt part 44 there is a helical thread 52.

The tool 54 illustrated in Figures 9 and 10 comprises a female mould 56 and a male mandrel 58. The mould 56 comprises two parts designated 60, 62.

The mould 56 has a cavity 64 (see particularly Figure 10) bounded by a transverse end surface 66 and a cylindrical side surface 64.

The part 62 of the female mould 56 has a runner 66 through it and a

sprue 68 connecting the runner 66 to the cavity 64 of the mould 56.

The mandrel 58 comprises a cylindrical core 70 with a stem 72 protruding from it. The mandrel 58 also comprises a rod 74 which is co-axial with the core 70 and the stem 72 and is both rotatable and axially shiftable relative thereto. The final component of the mandrel 58 is a ring 76 which encircles the core 70 and the stem 72.

The core 70 and rod 74 define a composite end surface 78 which faces the surface 66 of the female mould 56. The core 70 also has a cylindrical side surface 80 which faces the surface 64 of the mould 56. The surface 80 has one or more helical grooves 82 cut into it.

The surfaces 66, 78 are parallel and spaced apart. Likewise the surfaces 64 and 80 are parallel and spaced apart.

The surface 80 of the core 70 intersects a conical surface 84 of the core along a circular line of intersection 86. The surface 84 tapers from the circular line of intersection 86 towards a flat, annular surface 88 where the stem 72 protrudes from the core 70.

The ring 76 has a bore 90 through it. The bore 90 has an inner surface 92 which tapers at an angle which is somewhat less than the angle of taper of the surface 84. Thus the surfaces 84 and 92 diverge from one another in the

direction away from the circular line 86. The surface 92 extends from one end face 94 of the ring 76 to an internal transverse surface 96. The tapering surface 92 has a series of notches 98 therein immediately adjacent the end face 94.

When the mould is closed, as shown in Figure 9, the circular edge 86 touches the surface 92 of the ring 76. This divides the mould cavity (see Figure 9) into a main part, designated MP1, and a subsidiary part, designated MP2, which are only in communication with one another through the notches 98. The greater part of the length of the skirt of the cap and a transverse end wall are moulded in part MP1 and a band forming the end part of the skirt of the cap is mounted in part MP2.

The end of the rod 74 is formed with a cross shaped indentation 100 (see particularly Figure 11c).

Synthetic plastics material of a type which can be shrunk by the application of heat is injected through the runner 66 and sprue 68. PET (polytetrafluoroethylene) is a suitable material.

The main cavity part MP1 fills with material which eventually flows through the notches 98 and into the subsidiary cavity part MP2.

Once the injected material has set, the mould is opened by separating the mould 56 and mandrel 58. The mandrel 58, but not the mould 56, is shown in Figure 11a with a cap 38 on the mandrel 58.

To eject the cap 38, the ring 76 is displaced axially with respect to the core 70. Such linear motion is converted by threading or other suitable means to rotary and translational motion of the rod 74. The cap 38 and rod 74 are at this time interconnected due to the plastics material in the indentation 100.

Thus the cap 38 is turned with respect to the core 78 (Figure 11b) and is eventually screwed off the stationary core 70 by virtue of the helical thread 52 which the threading 82 has moulded into the inside surface of the skirt 42 of the cap (see Figure 8). As will clearly be seen from Figure 10, the band 46 has to be expanded outwardly to permit the cap to be taken off the core 70 of the mandrel 58. The band 46 is thus stretched during manufacture and consequently, at the time the cap reaches the bottling plant, the band 46 is cylindrical and forms an extension of the main part 44 of the skirt 42.

Once the cap has been screwed onto a container and then heated, the band 46 shrinks back to its unstretched condition (as shown in Figure 8) and tightly grips the container. Re-heating makes the band 46 and bridges 48 brittle. There is usually a protruding circumferentially extending bead between the open mouth of the container and the band, and the band pulls tightly under this bead.

Experimental work shows that the band splits axially, and/or all the bridges break, immediately any attempt is made to remove the cap from the container.

It is possible to omit the runner and sprue and to use the technique known as compression moulding to manufacture the cap. Specifically a charge of plastics material is fed into the open cavity 64 and the mould is then closed to force material into the parts MP1 and MP2 of the mould cavity and into the notches 98 which join the cavity parts.

To facilitate removal of the cap from the mandrel, the core 70 can taper very slightly from top to bottom (as viewed in Figure 10). Similarly, the thread 82 can taper so that its dimensions reduce in the top to bottom direction.